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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	) **BEFORE THE BOARD OF PATENT**
	) **APPEALS AND INTERFERENCES**
Ronald E. MALMIN	)
	) Appeal No.:
Serial No. 10/633,935	)
	) Examiner: Constantine Hannaher
Filed: August 4, 2003	)
	) Group Art Unit: 2884
For: GAMMA CAMERA USING	)
ROTATING SCINTILLATION	) Monday, July 10, 2006
BAR DETECTOR AND METHOD	)
FOR TOMOGRAPHIC IMAGING	)
USING THE SAME	)

BRIEF ON APPEAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an appeal from the final rejection of claims 1-5, 7-15, 18, 19 and 21-25 of the above-identified application, which claims were finally rejected in the Office action dated January 6, 2006. A Notice of Appeal was timely filed on May 8, 2006.

REAL PARTY IN INTEREST

The real party in interest in this case is Siemens Medical Solutions USA, Inc. of Malvern, PA.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences, which would have any direct or indirect affect on the Board's decision in the present appeal.

STATUS OF THE CLAIMS

Claims 1-5, 7-15, 18, 19 and 21-25 are pending in the application. Claims 6, 16, 17 and 20 have been cancelled. Claims 1-5, 7-15, 18, 19 and 21-25 stand finally rejected. Claims 1, 11 and 19 constitute the independent claims on appeal. This appeal is directed to claims 1-5, 7-15, 18, 19 and 21-25.

STATUS OF AMENDMENTS

No proposed amendment after final has been filed in this application.

SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention relates generally to the field of nuclear medicine and systems for obtaining nuclear medicine images of a patient's body organs of interest. In particular, the present invention relates to a novel detector configuration for nuclear medical imaging systems that are capable of performing single photon emission computed tomography (SPECT) to obtain tomographic images.

Nuclear medicine is a unique medical specialty wherein radiation is used to acquire images that show the function and anatomy of organs, bones or tissues of the body. Radiopharmaceuticals are introduced into the body, either by injection or ingestion, and are attracted to specific organs, bones or tissues of interest. Such radiopharmaceuticals produce gamma photon emissions that emanate from the body. One or more detectors are used to detect the emitted gamma photons, and the information collected from the detector(s) is processed to calculate the position of origin of the emitted photon from the source (i.e., the body organ or tissue under study). The accumulation of a large number of emitted gamma positions allows an image of the organ or tissue under study to be displayed.

Single photon imaging, also known as planar or SPECT imaging, relies on the use of a collimator placed in front of a scintillation crystal or solid state detector, to allow only gamma rays aligned with the holes of the collimator to pass through to the detector, thus inferring the line on which the gamma emission is assumed to have occurred. Conventional single photon imaging techniques require gamma ray detectors that calculate and store both the two-dimensional position of the detected gamma ray (in x, y coordinate form) and its energy (typically in keV).

Because the conventional gamma or “Anger” camera uses a thin planar sheet or disk of scintillation crystal material, it is necessary to cover the entire field of view of the crystal with light detectors such as PMTs or photodiodes. PMTs do not contribute to high spatial resolution because of their large physical size (≈76 mm) and the uncertainty

in PMT output signals as a function of scintillation event position. The signal from a PMT as a function of position forms a bell-shaped curve (Light Response Function or LRF) whose slope (or lack thereof) introduces uncertainty as to the position of the scintillation event that produced it. Complex position calculating electronics thus are usually required to be used with PMT detectors.

The bar detector is a specific configuration of scintillation detector that has been used in astronomical and high energy physics applications. The bar detector consists of an elongated scintillation crystal bar having a relatively small cross section. A photosensor such as a PMT is optically coupled to each end of the bar. The light from a gamma photon event within the scintillation crystal volume is detected by the two PMTs. The relative amount of light collected at each of the two ends can be used to determine the location of the event in the bar. Additional bars can be placed next to each other for two dimensional detection.

A so-called rotating slit gamma camera is also known in the art, see, e.g., U.S. Pat. No. 4,514,632 to Barrett, issued Apr. 30, 1985. The rotating slit camera has an elongated slit provided in an opaque disk located between the imaging object and the detector, such that scintillation event detection is obtained only in one dimension along the length of the slit (i.e., only a single spatial coordinate is obtained) at a time. The disk is rotated with respect to the detector to obtain spatial position information along other directions. One advantage of the rotating slit camera is that it eliminates the requirement for the inefficient simple collimator or pinhole apertures in the conventional Anger

camera, which greatly restrict the percentage of gamma photons emanating from an imaging object that ultimately reach the detector.

According to the invention as set forth in claim 1, a gamma camera comprises a plurality of elongated bar detector strips made of scintillating material, arranged in a stack configuration; at least one solid-state photodetector coupled to at least one end of said stack normal to said elongated dimension; and a slat collimator including a plurality of elongated slats, for collimating each of said plurality of bar detector strips to receive gamma photons in only a single dimension. This is disclosed in Figs. 1A, 1B and 2, wherein a plurality of elongated bar detector strips 101 are provided in a stack configuration, with at least one solid-state photodetector (201, 202) coupled to at least one end of the stack normal to the elongated dimension, and a slat collimator including a plurality of elongated slats103, for collimating each of the plurality of bar detector strips 101 to receive gamma photons in only a single dimension. This is fully described in the specification at page 7, line 12 to page 8, line 16.

According to the invention as set forth in claim 11, a gamma camera comprises a plurality of elongated bar detector strips made of scintillating material; at least one photodetector coupled to an end of each of said bar detector strips normal to said elongated dimension; and a slat collimator including a plurality of elongated slats, for collimating each of said plurality of bar detector strips to receive gamma photons in only a single dimension. This is disclosed in Figs. 1A, 1B and 2, wherein a plurality of elongated bar detector strips 101 are provided in a stack configuration, with at least one

solid-state photodetector (201, 202) coupled to at least one end of the stack normal to the elongated dimension, and a slat collimator including a plurality of elongated slats103, for collimating each of the plurality of bar detector strips 101 to receive gamma photons in only a single dimension. This is fully described in the specification at page 7, line 12 to page 8, line 16.

According to the invention as set forth in claim 19, a method is provided of obtaining tomographic images of an object, comprising the steps of obtaining a plurality of sets of planar integral scintillation event data from said object at a plurality of azimuth angles of a rotating scintillation bar detector for each of a plurality of gantry angles of a gamma camera, said scintillation bar detector including a plurality of elongated bar detector strips made of scintillating material; at least one photodetector coupled to an end of each of said bar detector strips normal to said elongated dimension; and a slat collimator including a plurality of elongated slats, for collimating each of said plurality of bar detector strips to receive gamma photons in only a single dimension; and reconstructing said plurality of sets of planar integral scintillation event data to form a tomographic image of said object. his is disclosed in Figs. 1A, 1B and 2, wherein a plurality of elongated bar detector strips 101 are provided in a stack configuration, with at least one solid-state photodetector (201, 202) coupled to at least one end of the stack normal to the elongated dimension, and a slat collimator including a plurality of elongated slats103, for collimating each of the plurality of bar detector strips 101 to receive gamma photons in only a single dimension. This is fully described in the

specification at page 7, line 12 to page 8, line 16. Additionally, the steps of obtaining a plurality of sets of planar integral scintillation event data from said object at a plurality of azimuth angles of a rotating scintillation bar detector for each of a plurality of gantry angles of a gamma camera, are shown in Fig. 3 and described in the specification at page 8, line 20 to page 9, line 5.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

This appeal presents the following issues for review by the Board:

1) Whether claims 1, 2, 4, 5, 7-11, 13-15, 18, 19, and 21-25 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Zeng, U.S. Patent No. 6,762,413 in view of Miraldi, U.S. Patent No. 3,688,113, and are properly rejected on that basis; and

2) Whether claims 3 and 12 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Zeng and Miraldi further in view of Iwanczyk et al., U.S. Patent No. 6,521,894.

ARGUMENT

The Rejection of Claims 1, 2, 4, 5, 7-11, 13-15, 18, 19, and 21-25 Is Improper

The final rejection alleges that it would have been obvious to modify the Zeng reference to couple photodetectors to at least one end of the stack of detector elements 106 as suggested by Miraldi, in reliance on the assertion that "Zeng leaves the specific arrangement of the optical communication of the appropriate photodetector to the stack of bar detector strips 106 as a choice within the ordinary skill in the art (column 7, lines 34-35)."

The proposed modification, however, would not have been obvious to one of ordinary skill in the art, as further explained below. In order for a proposed modification of prior art to be obvious under 35 U.S.C. § 103, there must be some teaching, suggestion or motivation within the prior art itself for one of ordinary skill in the art to have made the modification. In re Lee, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002) (the factual inquiry whether to combine references must be based on objective evidence of record); In re Rouffet, 149 F.3d 1350, 47 USPQ2d 1453 (Fed. Cir. 1998) (the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination).

The final action dismisses Appellant's response as "attacking references individually." However, it is not improper to discuss what each prior art reference individually discloses to those skilled in the art, in establishing the lack of any teaching, motivation or suggestion in the prior art as a whole to make a proposed combination of

prior art references.

Miraldi discloses in Fig. 1 the use of a single detector 12, the components of which are shown in Fig. 2 and the physical configuration of which is shown in Fig. 7. As disclosed, the detector includes a rectangular scintillation crystal 86 mounted adjacent to a collimator 88, with photomultiplier tubes 96 and 98 mounted at each end of the scintillation crystal. Thus, Miraldi is not concerned with multiple scintillation elements located between multiple slats as disclosed by Zeng. Miraldi thus does not and cannot provide any suggestion to those skilled in the art as to photodetector placement in the apparatus of Zeng.

In particular, Zeng discloses in Fig. 4 a slat collimator 100, which is interposed between an imaging object and a detector head 22. Specifically, the slat collimator is mounted on a radiation receiving face 23 of the detector head 22 as shown in Figs. 5A-5B (see also Fig. 8, showing scintillation elements 106 mounted on detector head 22). In particular, Zeng contemplates an embodiment wherein a single scintillator element spans across all of the collimator slats 102 (see col. 7, ll. 48-51). From the teachings of Zeng, it is apparent that photodetector elements must be located within the detector head 22, and not left as a matter of choice as asserted in the final rejection.

First, Zeng at col. 7, lines 34-35 simply discloses that the detector elements 106 are fabricated from scintillation materials in optical communication with a photodiode or other appropriate photodetector. Such disclosure does not equate to a suggestion by Zeng that one of ordinary skill in the art should experiment with the placement of the

photodetectors. Plainly, the disclosed embodiments wherein a single scintillator element spans across all of the collimator slats, or wherein plural scintillator elements each span multiple collimator slats, could not perform correctly with photodetectors mounted as shown by Miraldi for a single one-dimensional scintillation crystal. Additionally, even in the embodiment of Zeng where a scintillation element 106 is provided for each gap between collimator slats, as shown in Figs. 5A-5B and 8, photodetectors are required to be located in the detector head 22.

Second, as pointed out above, Zeng clearly discloses a radiation receiving face 23 of the detector head 22, as shown in Figs. 5A and 5B. Inasmuch as the slats 102 and scintillation elements 106 are located above the radiation receiving face 23, those of ordinary skill in the art would have been led by Zeng to understand that the radiation receiving face 23 receives light radiation from the scintillation elements 106 and therefore must house the photodetector elements.

Given the stark differences between the one dimensional single collimated scintillation crystal detector of Miraldi and the planar detector heads 22 of Zeng, one of ordinary skill in the art would not have been motivated by the disclosure of Miraldi to have modified Zeng as proposed.

The Rejection of Claims 3 and 12 Is Improper

Iwanczyk et al. fails to cure the basic deficiency in the proposed combination of references. While Iwanczyk shows the use of a silicon drift photodetector (SDP), such

is also mounted as shown in Fig. 1 along the long dimension of a scintillator 37. Consequently, Iwanczyk also fails to disclose or suggest a gamma camera as set forth in the claims pending in the present application.

CONCLUSION

In view of the foregoing, claims 1-5, 7-15, 17-19 and 21-25 are submitted to be directed to a new and unobvious gamma camera and method of nuclear medical imaging, which is not taught by the prior art. The Honorable Board is respectfully requested to reverse all grounds of rejection and to direct the passage of this application to issue.

Please charge any fee or credit any overpayment pursuant to 37 CFR 1.16 or 1.17 to Novak Druce Deposit Account No. 14-1437.

Respectfully submitted,

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CLAIMS APPENDIX

1. A gamma camera, comprising:

a plurality of elongated bar detector strips made of scintillating material, arranged in a stack configuration;

at least one solid-state photodetector coupled to at least one end of said stack normal to said elongated dimension; and

a slat collimator including a plurality of elongated slats, for collimating each of said plurality of bar detector strips to receive gamma photons in only a single dimension.

2. A gamma camera as set forth in claim 1, further comprising a plurality of photodetectors each coupled to at least one end of each bar detector strip of said stack.

3. A gamma camera as set forth in claim 2, wherein said photodetectors are silicon drift detectors (SDDs).

4. A gamma camera as set forth in claim 2, wherein said photodetectors are photodiodes.

5. A gamma camera as set forth in claim 1, wherein said bar detector strips are formed of CsI.

7. A gamma camera as set forth in claim 1, wherein each bar detector strip is located between individual slats of said slat collimator.

8. A gamma camera according to claim 7, wherein each of said individual slats has a length matching the length of said bar detector strips.

9. A gamma camera as set forth in claim 1, wherein said slat collimator is mounted adjacent to said stack.

10. A gamma camera according to claim 9, wherein each of said individual slats has a length matching the length of said bar detector strips in said stack, and wherein spacing between slats of said slat collimator matches dimensions of said bar detector strips.

11. A gamma camera, comprising:

a plurality of elongated bar detector strips made of scintillating material;

at least one photodetector coupled to an end of each of said bar detector strips normal to said elongated dimension; and

a slat collimator including a plurality of elongated slats, for collimating each of said plurality of bar detector strips to receive gamma photons in only a single dimension.

12. A gamma camera as set forth in claim 11, wherein said photodetectors are silicon drift detectors (SDDs).

13. A gamma camera as set forth in claim 11, wherein said photodetectors are photodiodes.

14. A gamma camera as set forth in claim 11, wherein said bar detector strips are formed of CsI.

15. A gamma camera as set forth in claim 11, wherein each bar detector strip is located between individual slats of said slat collimator.

18. A gamma camera according to claim 15, wherein each of said individual slats has a length matching the length of said bar detector strips.

19. A method of obtaining tomographic images of an object, comprising the steps of:

obtaining a plurality of sets of planar integral scintillation event data from said object at a plurality of azimuth angles of a rotating scintillation bar detector for each of a plurality of gantry angles of a gamma camera, said scintillation bar detector including a plurality of elongated bar detector strips made of scintillating material;

at least one photodetector coupled to an end of each of said bar detector

strips normal to said elongated dimension; and

a slat collimator including a plurality of elongated slats, for collimating each of said plurality of bar detector strips to receive gamma photons in only a single dimension; and

reconstructing said plurality of sets of planar integral scintillation event data to form a tomographic image of said object.

21. A gamma camera according to claim 1, further comprising at least a second photodetector coupled to a second end of said stack.

22. A gamma camera according to claim 2, wherein photodetectors are coupled to both ends of each bar detector strip of said stack.

23. A gamma camera as set forth in claim 11, wherein said slat collimator is mounted adjacent to said plurality of bar detector strips.

24. A gamma camera according to claim 23, wherein each of said elongated slats has a length matching the length of said bar detector strips, and wherein spacing between slats of said slat collimator matches dimensions of said bar detector strips.

25. (Previously presented) A gamma camera according to claim 11, wherein

photodetectors are coupled to both ends of each bar detector strip of said stack.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None